

DRAWINGS ATTACHED

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(54) ELECTRICAL CONSTRUCTIONAL KITS

(71) We, INTERTRADING CORPORATION ESTABLISHMENT, a body corporate organised under the laws of Liechtenstein of Hauptstrasse 22, Vaduz, Liechtenstein, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to electrical constructional kits, and is an improvement in or modification of the invention in our Patent No. 1,082,036.

15 A "kit for constructing electrical circuits" as used herein specifies a kit comprising a plurality of building bricks or units each housing at least one electrical circuit integer electrically connected to at least one contact plate on at least one face of the unit, each said unit

20 having in at least two faces a permanent magnet disposed in such a manner that when two units are placed together the necessary contact pressure between contact plates of said two units is produced by magnetic attraction.

25 According to one aspect of the present invention there is provided a "kit for constructing electrical circuits" as herein specified including a base plate having a substantially level upper surface on which the units may be mounted; at least one contact block, electrical connecting means provided on the or each contact block; and means for holding the or each contact block on the base plate.

30 The electrical connecting means may comprise sockets which are accessible from opposite sides of the or each contact block; and wherein flexible electrical leads connected with the sockets may be provided.

35 Preferably the or each contact block includes

a contact plate on an undersurface thereof adapted to make electrical contact with the base plate. Conveniently, the means for holding the or each contact block on the base plate may comprise a permanent magnet.

40 The kit as specified in the third paragraph above may include electrical connecting means for connecting at least one unit with a circuit component arranged outside the or each unit. These electrical connecting means may comprise soldering lugs connected with the contact plates of the or each unit, the soldering lugs projecting beyond an external surface of the unit. At least one of the units can carry a representation on its upper surface of an ear phone, said at least one unit having an ear phone connected thereto by means of a wire.

45 According to a further aspect of the present invention there is provided a "kit for constructing electrical circuits" as herein specified in which the contact plates are resilient.

50 According to a yet further aspect of the present invention there is provided a "kit for constructing electrical circuits" as herein specified including a base plate having a planar surface divided into a plurality of squares, the dimension of the edges of each square being equal to n times the horizontal dimension of the sides of the units, n being a whole number.

55 The base plate may be of magnetic material. Means may be provided to enable the base plate to be disposed substantially vertically. Preferably, at least one of the units is a motor unit having pole pieces and an armature of a commutator motor mounted in it. The kit can include field magnets, each of which is mounted in a block separate from the motor unit, for completing the magnetic circuit of the motor unit, said field magnet blocks being

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adapted to make a magnetic circuit through the base plate with the motor unit.

5 Some units may have a rectangular plan while other units in plan have substantially the shape of an isosceles triangle, at least two of the sides of each unit of triangular plan having the contact plates and the magnets mounted in them.

10 The invention is illustrated, merely by way of example, in the accompanying drawings, in which:—

Figure 1 is a perspective view of a base plate with various units and a contact block.

15 Figure 2 is a perspective view of a unit with soldering connections.

Figure 3 is a circuit in the form of a block diagram.

Figure 4 is a perspective view of a unit showing the connection of a lid.

20 Figure 5 is a plan view of a unit containing a motor armature with two laterally placed field magnet units.

Figure 6 is a section on the line 6—6 of Figure 5.

25 Figure 7 is a view of the units for a series motor construction.

Figure 8 is a view of a shunt motor.

Figure 9 shows units forming a rectifier.

30 Figure 10 is a plan, on a larger scale, of a unit of substantially triangular plan with the lid partly broken away.

The embodiment of the invention as shown in Figure 1 comprises a base plate 110 which is provided with a contact block 150 held in place by means of permanent magnets 152 which are arranged inside the contact block 150 in its base. The magnets 152 are sufficiently strong to prevent the contact block being displaced by forces which might be exerted by manoeuvring electrical measuring leads 154 plugged into sleeves or sockets 156 in the contact block. The measuring leads 154, are connected with an external measuring device, for example, an oscilloscope, (not shown) and are not very flexible. Therefore the magnetic attraction between the magnets 152 and the base plate 110 must be sufficiently strong to ensure that the forces exerted by the measuring leads 154 do not cause displacement of the contact block 150. The sockets 156 receive respective plugs 158 on the side of the contact block 150 opposite the measuring leads 154 and the plugs can be connected by means of light, flexible leads 160 to a building brick or unit 162 which is to form part of an electrical circuit. The unit 162 has two sockets which are separately connected to respective contact plates. The unit 162 is particularly suitable for allowing measurement of current flowing within a circuit to be ascertained. For measuring purposes other units, such as the unit 164, can be provided. The unit 164 has a first socket connected to a resilient contact plate (not shown) on one of its sides, and a second socket connected

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to a resilient contact plate (not shown) on its bottom surface. Other arrangements of units provided with sockets can be devised, for example, a socket may be connected with a straight piece of electrical line or wire, or with a T-junction, or with a cross-over junction, so that the socket may be electrically connected with the two, three or four measuring leads (not shown) as the case may be.

In order to facilitate the construction of an electrical circuit, optical guide lines 163, 165 are provided on the base plate 110. These guide lines, for example, in the form of grooves, are of a chequer-board configuration, the spacing between the lines corresponding to the respective dimensions of a unit or a multiple of them. That is to say, the dimension of the edges of each square is equal to n times the horizontal dimension of the sides of the unit, n being a whole number.

As is shown in Figure 1, the kit includes a block-like prismatic unit 166, which can be used in an electrical circuit, and which carries the symbol of an ear phone. An ear phone 168 is connected to the unit 166 by means of a light flexible lead 167.

Figure 1 further shows a unit 170 with sockets for the insertion of resistors as may be required. On its top face it carries an electrical circuit representation indicating a resistance and the connotation Rx. The unit 172 has sockets for the insertion of capacitors as may be required and its top face carries an electrical circuit representation indicating a capacitor and the connotation Cx. The unit 173 has an electrical circuit representation indicating a transistor and has three sockets for the insertion of a standard plug carrying the type of transistor that is required.

The block 150 besides sleeves 156 (denoted plus and minus) arranged in pairs, and the plugs 158, also carries further sockets 174 and 175, the socket 174 being connectable with a corresponding plug in order to provide for the connection to the electrical circuit of a potential which is more negative than earth. The socket 175 is earthed by means of contact plates in the bottom face of the contact block 150 to the base plate 110, so that earth potential can be connected *via* the socket 175 to a measuring instrument.

Figure 2 is a perspective view of an individual unit 176 which is three times as long as a basic unit and which has resilient contact and holding plates 178. The contact and holding plates 178 are connected with soldering lugs 180 which pass up through the top part of the unit 176 and which may be soldered to circuit components as required.

Figure 3 shows a block circuit diagram constructed in accordance with the invention, the individual units containing whole parts of circuits or circuit stages. Thus the unit 182 includes a complete amplifier with its own cur-

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rent supply. Alternatively the unit 182 can be adapted for connection with a battery unit 136 (as shown in broken lines).

Figure 4 is a perspective exploded view, on a larger scale, showing a simple means of attachment of the top lid part 184 of a unit 186. At two opposite corners or at all corners the unit 186 is provided with generally vertical recesses 188 having a triangular horizontal cross-section. Round vertical pins 190 on the lid part 184 fit into these recesses, the lid-part 184 carrying a representation of a circuit integer. The diameter of the pins 190 is so related to the cross-section of the recesses 188 that there is an interference fit to hold the lid-like top part 184 in position after the pins have been pushed home.

Figures 5 to 8 show further forms of units for the construction of various motors or dynamos. A square brick or unit 111, disposed on the base plate 110, carries, by means of bearings, a vertical shaft 112 of a double-T armature 113. The shaft 112 projects upwards through the top part of the unit. Coils 114 are connected with the segments 115 and 116 of a radial commutator. The segments 115 and 116 cooperate with brushes 117 which are fixed inside the unit and are connected with resilient contact plates 118 arranged at the sides of the unit. Permanent magnets are arranged behind these contact plates for making a magnetic connection and electrical contact with other units.

The unit 111 also carries pole pieces 119 spaced from the poles of the armature 113 by a small air gap. The pole pieces 119 project through an opening 120 in the side wall of the unit sufficiently far as to be flush with the outer surface of the side wall, though in order to provide for better contact with further parts of a magnetic circuit, the end face of these pole pieces can, instead of being flush with the outer surface, project slightly beyond it.

The block 121 shown on the right-hand side of unit 111 in Figures 5 and 6 accommodates an electro-magnet whose coil 122 is wound around a vertical limb 123 of an L-shaped iron core whose horizontal limb 124 projects through a lateral opening 125 in the side wall of the block 121 and thus comes into contact with the pole piece 119 of the unit 111 when the two units are placed together. The two ends of the coil or winding 122 are connected with oppositely arranged lateral resilient contact plates 126 similar to contact plates 118 of unit 111. The vertical limb 123 of the iron core projects through a bottom opening 127 of the block 121 and makes contact with the base plate 110.

A block 128 shown connected up on the left of the unit 111 in Figures 5 and 6 accommodates an L-shaped permanent magnet 129 which again projects through an opening 127 in the bottom plate and is in contact with the base plate 110 so as to make a magnetic at-

tachment. The permanent magnet 129 includes an iron core 130 which projects through a lateral opening 125 and makes contact with the pole piece 119 of the motor. It is clear that the magnet parts 129 and 130 can be made in one piece.

For reasons of convenience either permanent field magnets or electro-magnets are used on both sides of the unit 111. Figures 5 and 6 are only intended to show the possibility of the use of the two sorts of magnets and is not intended to indicate that two different sorts are necessarily used simultaneously.

The magnetic flux circuit of the motor runs through the armature, the pole pieces, the field magnets and the base plate 110. The supply of current to the armature is made through the contact plates 118. The supply of current to the field electro-magnets and the connection of the contact plate 118 connected with the brushes 117 is made through units containing pieces of electrical line. In order to avoid the use of such line connections the contact plates 126 and 118 can be so arranged in the contiguous side faces of the unit 111 and block 121 that simultaneously with the closing of the magnetic circuit electrical contact is made between the field magnets and the motor armature. However, it would generally be more convenient, in order to allow ready appreciation of the circuit visually and to provide for the possibility of constructing series and shunt motors or generators, to provide contact plates so that they project from the free vertical faces.

Both the unit 111 accommodating the armature and the blocks 121 and 128 accommodating the field magnets can be provided with holding magnets to attach the units to the base plate, in addition to their field magnets.

As can be seen from Figures 7 and 8, the top lid parts of the unit 111 and block 121 carry printed conventional circuit symbols or representations for the armature and the field magnet. Figure 7 indicates the construction of a series motor by means of units 132 having line sections, and a unit 131 having an electrical connection with the base plate 110 for providing a return current path.

Figure 8 shows the construction of a shunt motor using units 132, a current return path through the base plate again being provided by units 131.

A bridge rectifier circuit shown in Figure 9 is built up of square prismatic units 101 and prismatic units 102 which have the form of a right-angled isosceles triangle with two truncated corners.

In the vertical side faces of the units 101 and 102 electrically conducting resilient contact plates 103 are fitted behind which there are arranged round magnets 104 as shown in Figure 10. In the case of the substantially triangular units 102 the three resilient contact plates are electrically connected at the three

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- vertical sides of the units by means of lines 105. The edge length of the two mutually perpendicular side faces or walls 106 and 107 of the unit 102 are equal to the edge length of the units 101, which are square in plan. The edge length of the face 108 forming the base is also equal to the edge length of a unit 101 owing to the truncation of the corners at 109.
- 10 Means (not shown) may be provided to enable the base plate to be disposed substantially vertically.
- WHAT WE CLAIM IS:—
- 15 1. A "kit for constructing electrical circuits" as herein specified including a base plate having a substantially level surface on which the units may be mounted; at least one contact block, electrical connecting means provided on the or each contact block; and means for holding the or each contact block on the base plate.
- 20 2. A kit as claimed in claim 1, in which the electrical connecting means comprise sockets which are accessible from opposite sides of the or each contact block; and wherein flexible electrical leads connected with the sockets are provided.
- 25 3. A kit as claimed in claim 1 or 2 including a contact plate on an undersurface of the or each contact block adapted to make electrical contact with the base plate.
- 30 4. A kit as claimed in any of claims 1 to 3 in which the means for holding the or each contact block on the base plate comprises a permanent magnet.
- 35 5. A kit as claimed in any preceding claim including electrical connecting means for connecting at least one unit with a circuit component arranged outside the or each unit.
- 40 6. A kit as claimed in claim 5 in which said electrical connecting means comprise female sockets for receiving electrical leads.
- 45 7. A kit as claimed in claim 5 in which said electrical connecting means comprise soldering lugs connected with the contact plates of the or each unit, the soldering lugs projecting beyond an external surface of the unit.
- 50 8. A kit as claimed in any of claims 1 to 6 in which at least one of the units carries a representation on its upper surface of an ear phone, said at least one unit having an ear phone connected thereto by means of a wire.
- 55 9. A "kit for constructing electrical circuits" as herein specified in which the contact plates are resilient.
- 60 10. A "kit for constructing electrical circuits" as herein specified including a base plate having a planar surface divided into a plurality of squares, the dimension of the edges of each square being equal to n times the horizontal dimension of the sides of the units, n being a whole number.
- 65 11. A kit as claimed in claim 10 in which the base plate is of magnetic material.
12. A kit as claimed in claim 10 or 11 in which at least one of the units has a lid with vertical plugs at the corners thereof, the plugs being received in vertical sockets in the corners of the remainder of the unit with an interference fit.
13. A kit as claimed in claim 12 in which the vertical sockets are of polygonal cross-section while the plugs are round in cross-section.
- 70 14. A kit as claimed in any of claims 10 to 13 in which means are provided to enable the base plate to be disposed substantially vertically.
- 75 15. A kit as claimed in any of claims 10 to 14 in which at least one of the units is a motor unit having the pole pieces and armature of a commutator motor mounted in it.
- 80 16. A kit as claimed in claim 15 including field magnets, each of which is mounted in a block separate from the motor unit, for completing the magnetic circuit of the motor unit, said field magnet blocks being adapted to make a magnetic circuit through the base plate with the motor unit.
- 85 17. A kit as claimed in claim 16 in which the field magnets are in the form of permanent magnets which are of L-shaped cross-section, each magnet having one end adapted to contact a pole piece of the motor unit, and having another end adapted to contact the base plate.
- 90 18. A kit as claimed in claim 16 in which the field magnets of the motor are in the form of electro-magnets whose magnetic cores are of L-shaped cross-section, each core having one end adapted to contact a pole piece of the motor unit, and having another end adapted to contact the base plate.
- 95 19. A kit as claimed in any of claims 17 or 18 in which the said another end of each field magnet extends through a recess in the base of the field magnet block.
- 100 20. A kit as claimed in any of claims 15 to 18 in which the shaft of the motor is vertical and projects through the top surface of the motor unit.
- 105 21. A kit as claimed in claim 16 in which the motor unit and field magnet blocks have contact making means which are arranged to ensure that, on closing the magnetic circuit, the electrical circuit is simultaneously closed.
- 110 22. A kit as claimed in claim 21 in which the unit with the motor unit is provided with a magnet for attachment to the base plate.
- 115 23. A kit as claimed in any of claims 15 to 22 in which the motor unit is of rectangular plan section and in this section is twice as long and twice as broad as other units in the kit.
- 120 24. A kit as claimed in claim 23 when dependent on claim 16 in which the field magnet blocks are rectangular and equal in height to the height of the motor unit and have a longer side of the same length as an adjacent side of the motor unit, the shorter sides of the field magnet blocks being half the length of the longer sides of the motor unit.
- 125 25. A kit as claimed in claim 9 in which some of the units have a rectangular plan while
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other units in plan have substantially the shape of an isosceles triangle, at least two of the sides of each unit of triangular plan having the contact plates and the magnets mounted in them.

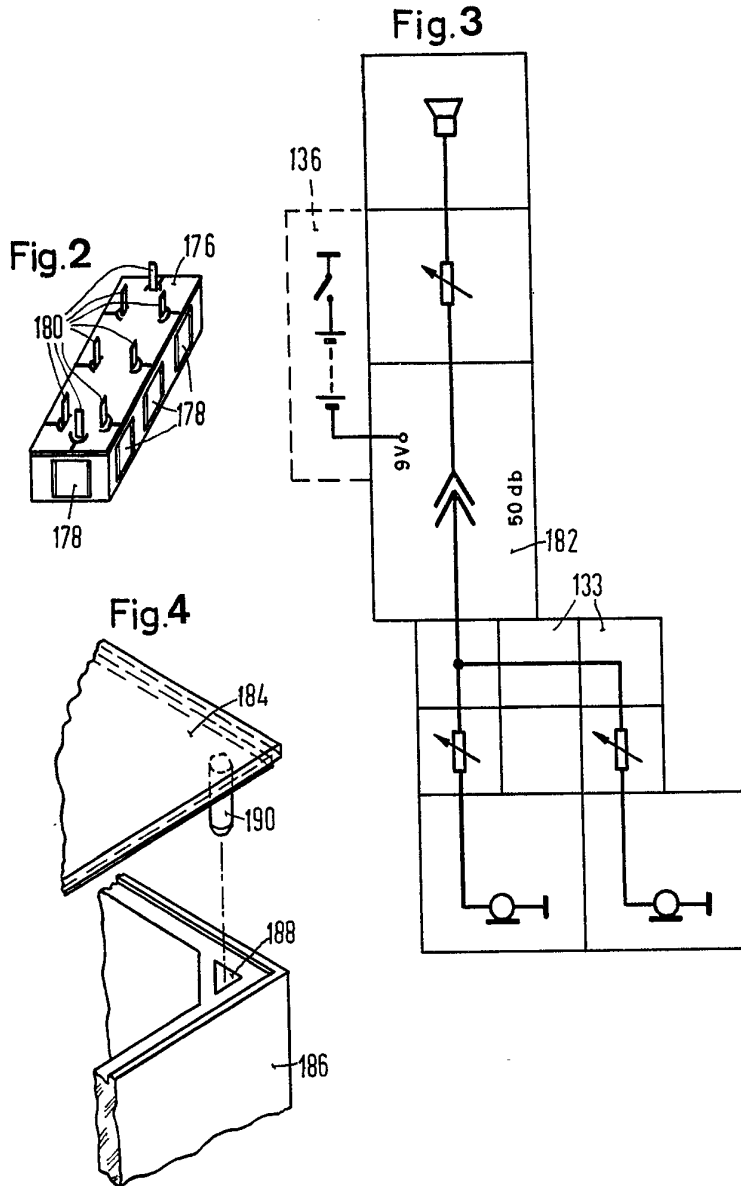
5 26. A kit as claimed in claim 25 in which the units of triangular plan have substantially the shape of a right-angled isosceles triangle.

10 27. A kit as claimed in claim 26 in which the substantially triangular units have contact plates and magnets in all three sides.

28. A kit as claimed in claim 26 or 27 in which the corners opposite said right angle are truncated so that the unit has three sides of substantially equal length.

29. A "kit for constructing electrical circuits" as herein specified and substantially as herein described with reference to and as shown in Figure 1 or Figures 1 and 2 or Figures 1 and 3 or Figures 5, 6, 7 and 8 or Figures 9 and 10 of the accompanying drawings. 15 20

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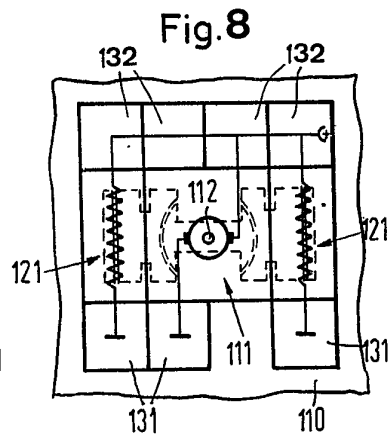
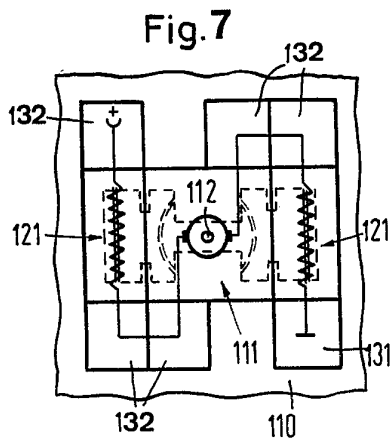
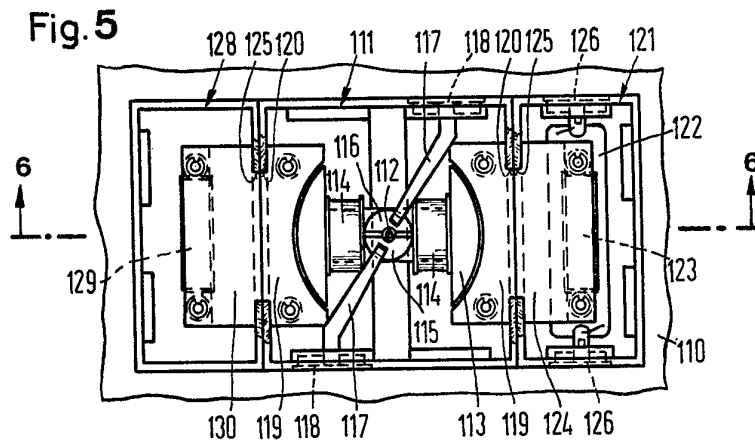
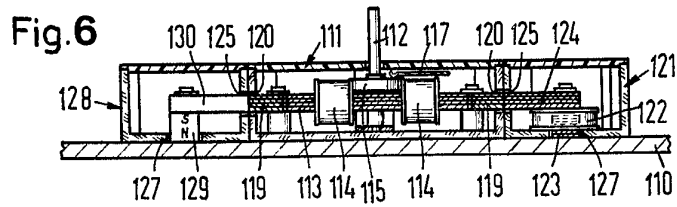


Fig.9

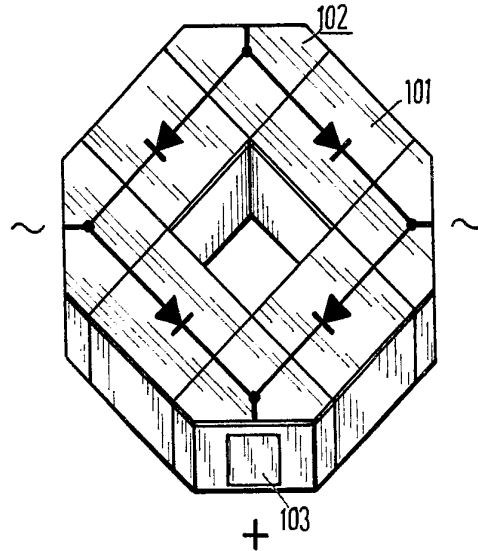


Fig.10

